SECTION 4

SANITARY SEWER DESIGN REQUIREMENTS

Original Ordinance Number: 00-09-16
Revisions: 01-04-30, 02-09-98, 03-04-25

SECTION 4 - SANITARY SEWER DESIGN REQUIREMENTS

4.01 GENERAL: (Ordinance No. 02-09-98, 03-04-25)

A. Design criteria for all sanitary sewer systems shall comply with Texas Commission on Environmental Quality (TCEQ) Chapter 317 (Design Criteria for Sewerage Systems), latest revision.

B. Sizes and grades for sanitary sewer shall be as required by the City Engineer, and consideration shall be given as to possible extensions for future development. No sanitary sewers, other than laterals and force mains, shall be less than eight-inch (8") in diameter.

C. Railroad, State Highway and Tollroad crossings, etc., in addition to connections to NTMWD shall be as approved by the City Engineer. Permits to agencies other than the city must be submitted through the city.

D. The Engineer shall include on the design plans a summary of pipe sizes and pipe materials.

E. All grades shall be shown to the nearest one-hundredth of a foot (0.01').

F. Where applicable, line sizes shall comply with the Sanitary Sewer Layout Master Plan or subsequent revisions.

G. Sewer lines shall be sized and extended through the limits of a development to serve adjacent properties. In phased construction of thoroughfares, the sewer lines shall be extended the entire length of the thoroughfare being constructed.

H. Construction Staking - Line and grade stakes for construction of all mains and laterals shall be furnished by the developer's Engineer or their designated representative. Property lines and corners must be properly staked to ensure correct alignment. The City will not be liable for improper alignment or delay of any kind caused by improper or inadequate surveys by the developer or by interference of other utilities.

4.02 SEWER LINE LOCATION:

A. If feasible, sewers shall be placed in streets under paving. Sewers are usually located in the center of the street. Each project is unique; therefore, no fixed rules will apply to all cases.

B. No public sewer line shall be located nearer than five feet (5') from any tree.

C. No sanitary sewer shall be located in alleys unless approved by the City Engineer.

4.03 SEWER LINE MATERIALS: (Ordinance No. 02-09-98)

The material used for the sanitary sewer shall be designed for a minimum structural life cycle, of fifty (50) years. If the pipe material will deteriorate when subjected to corrosive conditions, the Engineer shall provide, for an acceptable corrosion resistant liner or provide calculation and data that demonstrated that the design and operational characteristics will provide for the minimum life cycle.

A. All gravity sewer pipe shall be in green in color. Four-inch (4") to fifteen-inch (15") pipe shall be PVC SDR 35 or 26 (ASTM D3034). Eighteen-inch (18") and larger pipe shall be PVC ASTM F679. PVC fittings may be either green or white in color.

B. Ductile Iron Pipe, minimum class 51 or 52, shall be used for all aerial crossings. It may also be used on a case by case basis with written approval from the City Engineer.

C. Reinforced Concrete Pipe is allowed only on a case by case basis and then only, on lines larger than thirty

inches (30″) in diameter. The City of Frisco will issue written approval for use of RCP on those projects.

D. All mains to be installed under existing roadway should be installed by bore unless otherwise approved by the City Engineer. Rust resistant steel casing minimum one-fourth-inch (1/4″) thick, or thicker if deemed necessary by the design engineer, shall be used with Raci patented casing spacers, or approved equal. No wood skids will be allowed.

E. Vitrified clay pipe will not be allowed in the City of Frisco.

F. PVC pipe used for force mains shall be white in color. Twelve-inch (12″) and smaller pipe shall be ASTM 2241 SDR 21. Pipes larger than twelve-inch (12″) shall be C905 DR25.

G. Profile wall pipe shall not be permitted in the City of Frisco without written authorization by the City Engineer. If allowed by the City Engineer, twenty-four inches (24″) and larger profile wall pipe shall conform to ASTM 794 and the City of Frisco specifications. "Helically wound" or "pipe stiffness series 10" profile wall pipe will not be allowed.

4.04 CLEANOUTS AND MANHOLES: (Ordinance No. 02-09-98)

The sizes and locations of manholes, wyes, bends, tap connections, cleanouts, etc., shall be approved by the City Engineer. In general, manholes shall be placed at all four (4) way connections and three (3) way connections, changes in grade and direction, and the maximum spacing five hundred feet (500′).

A. In order to provide access for sewer lines for cleaning, manholes and/or cleanouts shall be so located that two hundred fifty feet (250′) of sewer rod can reach any point in the line. Spacing between a manhole and an upstream cleanout shall be limited to three hundred feet (300′). Cleanouts may be located at the end of the line or on a line that may be extended in the future.

B. Manholes shall have a 400# traffic bearing frame and cover with a design strength of 4000 psi at twenty-eight (28) days.

C. Drop manholes shall be required when the inflow elevation is more than twenty-four inches (24″) above the outflow elevation. Drops can be either inside or outside the manhole with its flowline elevation located between the centerline and top of sewer main.

D. The diameter of a manhole constructed over the center of a sewer should vary with the size of the sewer. For eight-inch (8″), ten-inch (10″), and twelve-inch (12″), the manhole shall be four-foot (4′) minimum diameter, for fifteen-inch (15″), eighteen-inch (18″), twenty-one-inch (21″), twenty-four-inch (24″) and twenty-seven-inch (27″) shall be five-foot (5′) minimum diameter; thirty-inch (30″) and thirty-six-inch (36″) shall be six-foot (6′) minimum diameter. Manholes deeper than fifteen feet (15′) shall be a minimum of five-foot (5′) diameter.

E. In Flood Plains, sealed manholes "Type S" shall be used to prevent the entrance of storm water. Where more than three manholes in sequence are to be bolted and gasketed, every third manhole shall be vented two feet (2′) above the one hundred (100) year floodplain elevation or ten feet (10′) above the adjacent ground line, whichever is higher. The Engineer shall provide the elevation of the one hundred (100) year flood. Sealed manholes shall also be used in all areas subject to carrying drainage flow or in drainage ways.

F. Where pipes enter a manhole there shall be a minimum of two-tenths of a foot (0.2′) drop between inverts. Where unequal size pipes enter a manhole, crown of pipes should be at the same elevation.

G. Manholes shall have inflow protection inserts, minimum thickness of one-eight inch (1/8″), made of HDPE meeting ASTM D 1248 Class A, Category 5, Type 111. Insert shall include a lift strap and vent hole with vent disk as manufactured by Knutson Manhole Inserts or approved other.

H. Construct manholes at each end of lines that are installed by other than open cut and at each end of aerial crossing lines.

4.05 CURVED SEWERS: (Ordinance No. 02-09-98)

A. No vertical curves will be allowed.

B. Horizontal curvature may be by joint deflection or pipe flexure but not both. The Engineer must specify on the plans the method of deflection allowed and the allowable radius or joint deflection for each pipe size.

C. When pipe flexure is used, the minimum radius of curvature shall be equal to that recommended by the pipe manufacturer or 300*Do, where Do, is the average outside diameter of the pipe in inches, which ever is greater. The Engineer shall note on the plans that, when using pipe flexure, all joints are to remain fully seated.

D. If joint deflection will be used to provide horizontal curvature, the allowable deflection shall be 80% of the Manufacturer's recommended maximum joint deflection, or eighty percent (80%) of the National Reference Standard ASTM criteria maximum recommended joint deflection or by TCEQ Criteria, whichever is less. In no case shall the radius be less than two hundred feet (200').

E. Horizontal curves for sanitary sewers running lateral with public right-of-ways shall match change in street direction as near as possible. Horizontal curves will not be allowed across residential single family and duplex lots, without prior approval from the City Engineer.

F. Manholes on curved sewers shall be located at the P.C. or P.T. of the curve and a maximum spacing of four hundred feet (400') along the curve. Sewage flow shall be computed in accordance with Table 4.1 shown below, with the exceptions, as required by the City Engineer.

TABLE 4.1: Sanitary Sewer Daily Flow Calculations (Design for Peak Flow)

Land Use	Design	Calculation
Apartment	• 100 gallons per person per day. • 20 units per acre. • 3 persons per unit.	(100*20*3 * daily peak factor) + infiltration = (100*20*3*3)+650= 18,650 gallons per acre per day.
Residential	• 100 gallons per person per day. • 4.5 units per acre. • 3.5 persons per unit.	(100*4.5*3.5 * daily peak factor) + infiltration = (100*4.5*3.5*3)+650= 5,375 gallons per acre per day.
Patio Home	• 100 gallons per person per day. • 5 units per acre. • 3.5 persons per unit.	(100*5*3.5) * daily peak factor) + infiltration = (100*5*3.5*3)+650= 5,900 gallons per acre per day.
Town Home	• 100 gallons per person per day. • 10 units per acre. • 3.5 persons per unit.	(100*10*3.5 * daily peak factor) + infiltration = (100*10*3.5*3)+650 = 11,150 gallons per acre per day.
Hospital	• 200 beds. • 200 gallons per day per bed.	(200*200) + infiltration = (200*200) + 650 = 40,650 gallons per day.
Nursing Home	• 150 beds. • 90 gallons per day per bed.	(150*90) + infiltration = (150*90)+650 = 14,150 gallons per day.
Commercial/ Industrial/ Office	• 3,100 parking spaces per 34.7 acres. • 1 person per parking space. • 35 gallons per person per day.	3,100/34.7 acres = 90 persons per acre (90*35) + infiltration = (90*35) + 650 = 3,800 gallons per acre per day.

Note: Infiltration shall be 650 gallons per acre per day (GPAD) and the daily peak factor shall be 3 or based on time of concentration calculations as approved by the City Engineer.

G. The minimum acceptable "n" factor for use in design of sanitary sewers shall be 0.013. Pipes should be placed on such a grade that the velocity is not less than 2 fps or more than 10 fps. Minimum grades based on n = 0.013 shall be as follows:

TABLE 4.2: Minimum and Maximum Grades for Sanitary Sewer Mains

Size of Pipe (Inches)	Minimum Slope in (Percent)	Horizontal Curve (Percent)	Maximum Slope in (Percent)
8	0.33	0.35	8.40
10	0.25	0.27	6.23
12	0.20	0.22	4.88
15	0.15	0.17	3.62
18	0.11	0.13	2.83
21	0.09	0.10	2.30
24	0.08	0.09	1.93
27	0.06	0.07	1.65
30	0.055	0.065	1.43
33	0.05	0.06	1.26
36	0.045	0.055	1.12
39	0.04	0.05	1.01
>39	*		*

Note: For lines larger than thirty-nine inches (39") in diameter, the slope shall be determined using the following equation to maintain a minimum velocity of two feet per second (2 fps) and a maximum velocity of ten feet per second (10 fps).

$$V = (1.486/n)*(R^{2/3})*(S^{1/2})$$

Where:
- V = Velocity of flow in conduit in feet per second.
- n = Roughness coefficient of the conduit, dimensionless.
- R = Hydraulic radius of the conduit in feet, which is the area of the flow divided by the wetted perimeter (R=A/P).
- S = Slope of the hydraulic gradient in feet per foot.

4.06 DEPTH OF COVER:

A. Minimum cover shall be four feet (4'). In general, the minimum depth for sewer to serve given residential property with a four-inch (4") lateral shall be three feet (3') plus 2% times the length of the house lateral (the distance from the sewer to the center of the house). Thus, for a house one hundred thirty-five feet (135') from the sewer, the depth would be three feet (3') plus 2% x one hundred thirty-five feet (135') = 3.0 + 2.7 = five and seven-tenths feet (5.7'). The depth of the flow line of the sewer should then be at least five and seven-tenths feet (5.7') below the elevation of the ground at the point where the service enters the house. Profiles of the ground line twenty feet (20') past the building line will be required to verify that this criteria is met.

B. City Engineer shall authorize any exceptions. Concrete protection may be required.

C. On lines deeper than twelve feet (12'), a parallel sewer line will be required when laterals are to be attached.

4.07 LATERALS: (Ordinance No. 01-04-30, 02-09-98)

The sizes and locations of laterals shall be designated as follows unless otherwise directed by the City Engineer:

A. In general, for single-family dwellings, the lateral size shall be a four-inch (4") minimum. House laterals shall be installed ten feet (10') downstream from the center of the lot and shall have a ten-foot (10') separation from the water service. All residential sewer services shall be extended to a point ten feet (10') from the back of the property line at a maximum depth of five feet (5'). The service shall then be extended at a forty-five degree (45°) angle to four feet (4') above the finished grade and capped.

B. All sanitary sewer lines shall be tested for infiltration and exfiltration in accordance with standard specifications and as shown on the plans. Video camera inspections, low pressure air testing, vacuum testing of the manholes and mandrel testing are required on all sewer lines. In addition, all residential and commercial sanitary sewer services shall have video camera inspections. All testing shall be completed, reviewed and approved by the City of Frisco prior to any initiation of subgrade work.

C. Multiple units, apartments, local retail and commercial – six-inch (6") minimum.

D. Manufacturing and industrial - eight-inch (8") minimum or larger as required.

E. Manholes will be required on six-inch (6") and larger laterals where they connect to the main line.

F. Laterals will not be attached to sewer mains that are deeper than twelve feet (12').

G. Fittings are not permitted on laterals between the wye and the property line.

H. Deep cut or drop connections shall not be permitted.

I. A minimum of one (1) lateral per building shall be required. Also, a minimum of one (1) lateral per residential lot shall be required. Duplexes shall have two (2) laterals that shall be independently attached to the main.

J. All mains installed in future developed areas shall install laterals; the use of boots will not be permitted.

K. All sewer laterals crossing water mains shall conform to the requirements of the Texas Commission on Environmental Quality (TCEQ) Chapter 317 (Design Criteria for Sewerage Systems), latest revision.

4.08 SANITARY SEWER LIFT STATIONS:

Subdivisions will be laid out so that all sanitary sewer lines will be gravity flow lines when possible. If the use of a sanitary sewer lift station is approved, the lift station will be connected to the city's Systems Control and Data Acquisition (SCADA) system. The developer will pay all cost associated with the SCADA to include all labor, equipment, materials, and programming of the city's computer and testing. The SCADA equipment installed shall conform to the standard as noted per this section. Computerized Monitoring and Control Specifications for Sanitary Sewer Lift Stations.

4.09 SANITARY SEWER EASEMENTS: (Ordinance No. 02-09-98)

The following minimum width exclusive sanitary sewer easements are required when facilities are not located within public rights-of-way or easements:

A. Sanitary sewers are to be located within the center of a fifteen-foot (15') sanitary sewer easement.

B. In residential developments, sanitary sewer mains shall not cross residential lots unless specifically approved by the City Engineer or his/her designee, in which case the easement shall be located within a single lot.

C. For sanitary sewer lines deeper than ten feet (10′), the easement width shall be equal to 1.5 times the depth of the line rounded up to the nearest five feet (5′). Thus, for a sanitary sewer line twelve feet (12′) deep, the sanitary sewer easement would be 1.5 x twelve feet (12′) = 1.5 + 12 = eighteen feet (18′), rounded up to the nearest five feet (5′) = twenty feet (20′).